

waters, which act with inconvenient or dangerous rapidity on lead. * Dr. Lamb was led by his researches to imagine that no spring water whatever was destitute of this property in a dangerous degree. This wide conclusion is not supported by valid facts. Yet his work contains several accurate and instructive examples of the action in question."

He thus (p. 534) sums up the whole inquiry:—

"The general results of the preceding inquiries are, that rain or snow water for culinary use should not be collected from leaden roofs, nor preserved or conveyed in lead;—that the same rule applies to spring waters of unusual purity, where, for example, the saline impregnation does not exceed a 15,000th of the water;—that spring water which contains a 10,000th or 12,000th of salts may safely be conveyed in lead pipes, if the salts in the water be chiefly carbonates and sulphates;—that lead pipes cannot be safely used, even where the water contains a 4,000th of saline matter, if this consist chiefly of muriates;—that spring water, even though it contain a large proportion of salts, should not be kept for a long period in contact with lead;—and that cisterns should not be covered with lids of this metal."

In support of Christison's conclusion that perfectly soft water acts strongly on lead, unless "deprived of its gases by ebullition and excluded from contact with the air," we may first of all adduce the few remarks on this subject made by Dr. Paris in his "Treatise on Medical Jurisprudence," published in 1823. In vol. ii. page 337, of this work, it is said,—

"Pure water, provided the air be excluded, does not appear to exert any sensible action upon lead, but the combined influence of these agents converts the lead into a carbonate—a fact at once exemplified by the white line which is so constantly visible at the surface of the water preserved in leaden vessels. So well acquainted were the ancients with this fact, that we find frequent allusions to their works to the dangerous property of leaden utensils."

Professor Solly is said to have "showed," at the Royal Institution in 1847 (vide THE BUILDER for that year, page 235).—

"That unless water contains from one 8,000th to one 4,000th of its weight of earthy salts—such as sulphate of lime—it ought never to be taken internally if kept in leaden cisterns, these earthy salts protecting the lead from the action of the water."

Dr. Fownes, in his book on chemistry, published in 1844, states that—

"When clean metallic lead is put into pure (soft) water, and exposed to the atmosphere, a white, crystalline, scaly powder begins to show itself in a few hours, and very rapidly increases in quantity. This substance is due to the action of the carbonic acid dissolved in the water: it consists of carbonate in combination with hydrate. When common river or spring water is substituted for the pure liquid, its effect is scarcely observable, the little sulphate almost invariably present [query, at Tunbridge] causing the deposition of a very thin but closely adherent film of sulphate of lead upon the surface of the metal, which protects it from further action. It is on this account that leaden cisterns are used with impunity, at least in most cases, for holding water. If the latter were pure, it would be speedily contaminated with lead, and the cisterns be soon destroyed."

As to the "impunity" here alleged, we fear that this cannot as yet be safely taken for granted in any view of the apparently conflicting evidence on this moot question; and to show that it ought not to be so, we may here, parenthetically, refer our readers to the opinion of Dr. T. Thomson, already given in THE BUILDER.*

As to this same "impunity," of which Dr. Fownes assures us, Mr. H. Osborn, a practical chemist, and a correspondent of our own, already quoted, judiciously remarks,—†

"It is an erroneous opinion that lead has been used for centuries without causing any deleterious impregnation of water. I would ask if necessary investigations have been made in all parts of the country? and if the origin of every disease has been discovered? How many have fallen an early sacrifice, after a long and painful illness, without the cause having been known?"

We are by no means desirous of exciting

* Vide volume for 1849, page 22.
† THE BUILDER, vol. v. page 430.

alarm for which there may be little immediate or general occasion; but when a sense of fairness impels us to give evidence which we at the same time deem somewhat rash, and assurances of safety which we think there is but too much reason to fear the circumstances do not warrant, we also feel it incumbent on us to check the probable consequences of such evidence and assurance, by counterbalancing them, so far, with a glimpse of the opposite side of the question. Let us now proceed, however, with the evidence more particularly corroborative of Professor Christison's conclusions.

Dr. Brande, in his standard work on chemistry (p. 833), says, on the whole question of the action of water, soft and hard, on lead,—

"In distilled water free from air and in close vessels a clean surface of lead remains bright; but under the same circumstances in open vessels it soon tarnishes: small crystalline scales of oxide of lead are formed, a portion of which dissolves in the water, and is again slowly precipitated in the form of carbonate. In this case the oxygen is imparted by the air held in solution in the water. The film of oxide thus formed is soluble to a small extent in the pure water, and is thrown down in proportion as it passes into the state of carbonate. A very minute trace of sulphuric acid, or of a soluble sulphate in the water, entirely prevents this corrosive effect, and hence it is that common spring water is kept with considerable impunity in leaden cisterns, which, however, should have wooden and not leaden covers. In the latter case the vapour of the water below condenses upon the cover, and often tends to its rapid corrosion, it being, in fact, distilled water, and not therefore prevented in its action by any saline matters; so that, when water is to be kept in this way, as it generally is, for domestic use, its qualities should be cautiously inquired and examined into, as very deleterious effects have occasionally arisen from the solution of the oxide. Another source of contamination by lead may arise from electric action, as where iron or copper bars, screws, or pipes, are in contact with or soldered into lead; and in these cases, owing to the action of alkaline bases, as well as of acids upon the lead, danger may occur when it is thrown into an electro-negative as well as electro-positive state. The means of detecting lead are fortunately simple and delicate. A good epitome of all that relates to the action of water on lead will be found in Christison's Treatise on Poisons."

The evidence given before the General Board of Health, although some of it has been shown to corroborate Dr. Playfair's conclusions, appears to have led the reporter of that evidence on the whole to coincide so far with Dr. Christison's views.

"In the evidence of witnesses connected with the present hard-water supplies, we find strong allegations of the danger of the introduction of pure water, from its powerful action on lead. There can be no doubt of the more powerful action of soft water upon lead under given circumstances: which circumstances, however, we find from experience on a large scale seldom or never occur under a proper system of distribution. Some fatal accidents have been occasioned by the fall of leaves in leaden gutters and cisterns, the infusion of which appears to have caused powerful decomposition. The use of lead piping and lead cisterns has long been objected to, and the remedy would be the disuse of that metal. Iron piping is altogether better and cheaper than lead, and may now, it appears, at no great additional expense, be protected from oxidation by an earthenware glaze."

With reference to this last recommendation, it may be here remarked, that the water of Edinburgh, according to Dr. Christison, always yielded a trace of lead, until iron pipes were substituted for leaden ones.

The following remark in the Board's report implies that soft water is dangerous in lead, even with a constant supply, and hence, with less exposure of the lead to air than when the supply is intermittent:—

"Though we have been informed of no serious

* Where spring waters, therefore, pass through peaty soils, and become impregnated with peat, it becomes a serious question how far lead pipes and cisterns are consistent with safety in the use of such water, even though soft water were indisputably proved to be otherwise safer than hard. As in the fact of vegetable impregnations rendering water dangerous in use after contact with lead, the case of Amsterdam may be instanced. The noted colic of Amsterdam is said by Tronchin, who wrote a history of the epidemic, to have been occasioned by leaves falling and purifying in leaden cisterns filled with rain-water. Indeed, the water of Amsterdam had been collected from roofs during rain, and the colic appeared soon after the substitution of lead for tiles on the roofs, when it broke out with violence, and committed great ravages.

accidents from contamination with lead in any of the towns where new supplies of soft water have been introduced, we believe that minor injuries [slower deaths?] from such partial contaminations as Professor Clarke describes, may occur and pass unnoticed; and that for this reason, the use of lead pipes should be discontinued as early as practicable. As a question of danger, however, a preponderance of testimony establishes the conclusion that hard water, with an intermittent supply, is actually more dangerous than soft water with a constant supply."

That intermittency of supply has something notably to do with the apparent discrepancies and contradictions in the evidence on this important question, we are strongly persuaded; but at all events the sooner those to whose evidence the public chiefly look for a settlement of the question come to a mutual understanding on the subject the better, and our sole purpose in entering thus at some length into the apparently conflicting evidence, so far as it has already been gone into and rerun, is to enforce the necessity, as far as possible, of such an understanding, and to hasten its advent.

THE BUILDERS' BALL.

THE ball in aid of the funds of the Builders' Benevolent Institution took place on the 19th inst. at Willis's Rooms, St. James's, and passed off most agreeably and successfully. There were more than 600 persons present, and amongst its more prominent supporters we may mention, Mr. Alderman Cubitt, M.P. Mr. Lewis Cubitt, Messrs. George Locke, Thomas Nesham, J. Jay, Henry Johnson, H. Jackson, Stephen Bird, George Bird, the treasurer; Joseph Bird, the honorary secretary; Peter Pearce, J. Guerrier, J. Lymburn, and other influential members of the building trade.

One of the officers of the charity, who, in his most praiseworthy zeal in its behalf, thinks we can never say enough about the Institution he worthily represents, and that we have nothing else to do but write paragraphs in its praise, calls upon us in earnest terms to give "a glowing description of the ball and its beauties." Whom would he have us single out for "description?" that joyous little damsel there in whose hair the "sunbeams have got entangled?"—the tall damsel in pink who looks too dignified to be merry, and is standing just now by the alderman?—or that more ravenous face, still, however, showing a trace of recent illness, which is closer to him in more ways than one? We cannot do it—it is not in our way. We cannot set forth how Adams's band pleased all the daughters of Eve, that the master of ceremonies played his peculiar part well, and that the comestibles were ample for those who indulge in the very vulgar habit of eating. Suffice it for us to say that the whole affair was managed very well, and that the committee will probably realise 150*l.* in aid of the praiseworthy purposes of the institution. Terpsichore never moves more gracefully than when she takes steps to aid the Charities.

NOTES IN THE PROVINCES.

Cambridge.—A portion of Trinity Hall, comprising twenty-five rooms, was destroyed by fire on Friday last.

Norwich.—The statue of Nelson by Mr. Milnes, the sculptor of the Duke of Wellington's statue at the Tower of London, has been sent to Norwich. The figure is 9 feet in height, and clothed in uniform, with a cloak like a toga. Its *locus in quo* has yet to be decided on, and even the price has not been either fixed or subscribed beyond barely 400*l.* already collected.

Yarmouth.—The girders and other parts forming the new bridge are now completed in London. The abutments are finished on each side the river. One of the coffer-dams is in course of construction for one of the piers. The depth of the river is 24 feet at low water, and the foundations must be laid 6 or 9 feet below the present bed, which is all loose sand.—Norfolk Chronicle.

Leamington.—The contract for the cast-iron pipes for Leamington water-works has been